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(54) **COMPRESSOR PULSE WIDTH MODULATION**

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417/440

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228.3, 196.3; 418/55.5, 57

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,332,144	6/1982	Shaw .	
4,745,777	5/1988	Morishita et al. .	
4,747,756 *	5/1988	Sato et al.	417/307
4,982,572	1/1991	Moore .	
5,059,098 *	10/1991	Suzuki et al.	417/295
5,329,788	7/1994	Caillat et al. .	

5,342,186 *	8/1994	Swain	418/55.5
5,447,420	9/1995	Caillat et al. .	
5,611,674	3/1997	Bass et al. .	
5,613,841	3/1997	Bass et al. .	
5,741,120	4/1998	Bass et al. .	
6,047,557 *	4/2000	Pham et al.	62/228.5
6,120,255 *	9/2000	Schumann et al.	417/213
6,123,517 *	9/2000	Brooke et al.	417/299

* cited by examiner

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(57) **ABSTRACT**

A scroll compressor includes a capacity modulation system. The capacity modulation system has a piston that is connected to the non-orbiting scroll that disengages the non-orbiting scroll from the orbiting scroll when a pressure chamber is placed in communication with the suction chamber of the compressor. The non-orbiting scroll member moves into engagement with the orbiting scroll when the chamber is placed in communication with the discharge chamber. The engagement between the two scrolls is broken when the pressure chamber is placed in communication with fluid from the suction chamber. A solenoid valve controls the communication between the pressure chamber and the suction chamber. By operating the valve in a pulsed width modulated mode, the capacity of the compressor can be infinitely varied between zero and one hundred percent.

48 Claims, 8 Drawing Sheets

